



## Submerge Scooters

### Product comparison: Submerge N-19 and Dive Xtras Sierra



The N-19 and the X-Sierra both weigh in at under 50 pounds with the small Sierra having a ~5Kg/11 pound advantage. Both scooters have single NiMH battery packs, both consisting of 20x 1.2 volt cells for a 24 volt system; the N-19 choosing 20.5 A/h cells and the Sierra with 13 A/h cells.



However, there are many distinctions between the 2 products. Below is some data based upon the Tahoe benchmark ([www.tahoebenchmark.com](http://www.tahoebenchmark.com)):

**X - Sierra**  
**N-19**



MAXIMUM SPEED: the N-19 ran at 202 feet/min compared to the Sierra at 182 feet/min.

**X - Sierra**  
**N-19**



RANGE AT MAX SPEED: The N-19 (1.9 miles at 202 feet/min) outdistances the Sierra (1.4 miles at 182 feet/min) by a clear margin.

**X- Sierra**  
**N-19**



**Marathon performance:** When the N-19 is run on a cruise speed of 182 feet/min, the Sierra must be run on full speed just to keep up. At 182 feet/min, the more efficient N-19 motor uses ~ 360 watts, compared the the Sierra which uses 439 watts. This combined with the smaller batteries in the Sierra, results in a **80% range advantage to the N-19.** (2.5 miles compared to 1.4 miles)

At this speed, the Sierra has a limited runtime of 39 minutes, compared to the N-19 with 75 minutes.

**Traveling:** Both scooters can easily be transported on passenger aircraft. Although the N-19 weighs 5Kg more than the Sierra, due to the ~40 minute runtime, Sierra divers discover they need to bring an extra 5kg Sierra battery pack in order to do a second dive; so the traveling weights end up being the same. Here the N-19 has a financial advantage, as any Sierra diver will have to seriously consider buying a spare \$735 battery (as of 1/09).

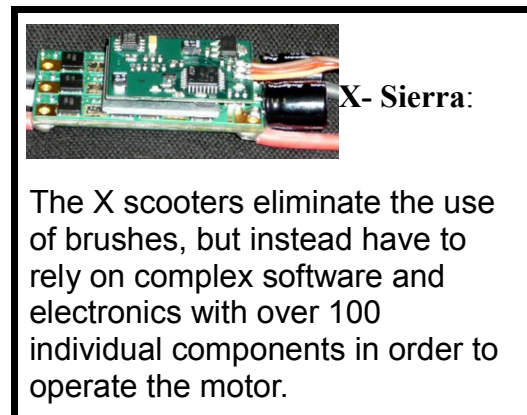
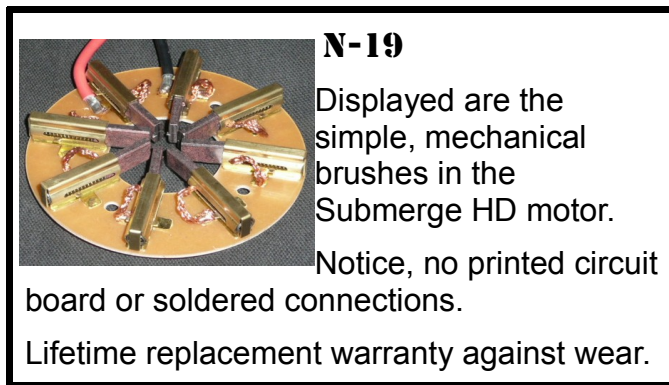
The N-19 can be transported along with personal items, stainless backplate, lights, 3 Regulators, wetsuit and fins within the weight limit of 2x 50 pound bags.

## Technology:

Both scooters use identical battery technology, use identical propellers and shroud designs, and utilize the same shaft seal design. Motor designs however are very different.

The N-19 uses the proprietary Submerge Heavy Duty brushed motor, which has proven reliability, and as can be seen from the data presented on page 1, is clearly the more efficient and powerful motor.

The X-Sierra, uses a less powerful brushless motor, which saves about 1.5 Kg in weight but sacrifices efficiency and power.



## Materials:

The N-19 is constructed of the most impact resistant, marine grade material available. The Main hull is constructed of industrial HDPE pressure pipe, with an estimated lifespan of over 100 years. We have seen this material exposed to direct sunlight in sunny Florida for 15 years with only slight, cosmetic surface damage from UV light; the mechanical properties are unchanged. There are no paint or coatings on the N-19 hull to scratch or wear off. (Scooters tend to get beat up due to their size and weight, not to mention racing through wrecks at 200 feet/min!)

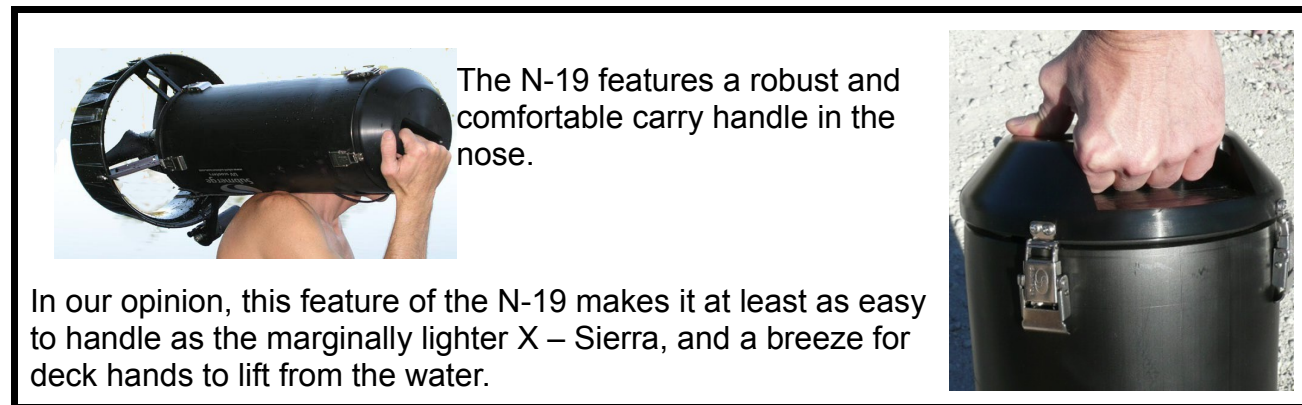
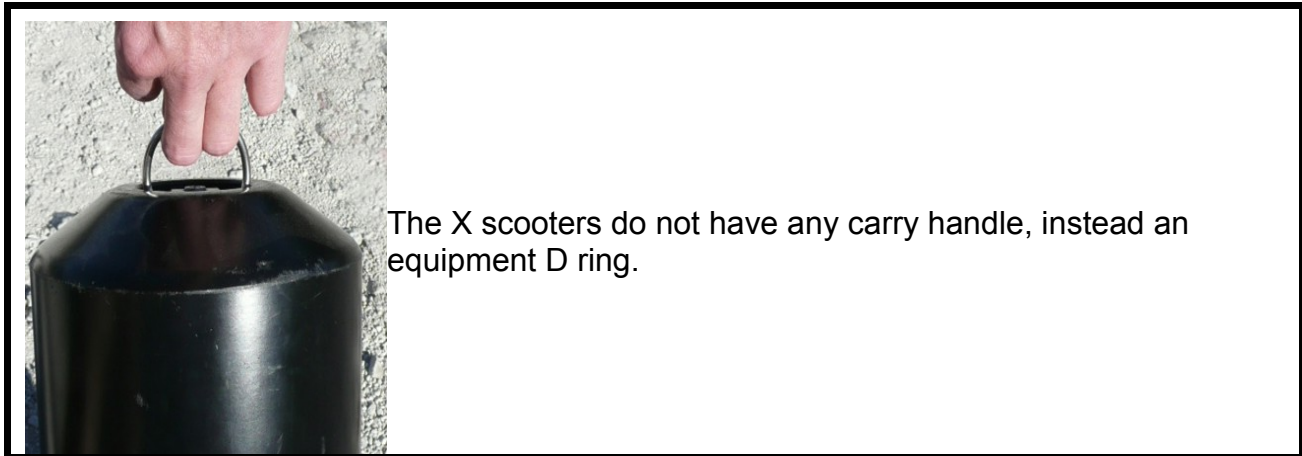
Being a plastic, it is impervious to corrosion in a marine environment; in addition it is impervious to fuels, acids and alkalies (Such as rebreather absorbent!)

The X- Sierra is constructed of aluminum, and supplemented with various coatings and anodic protections, precisely because aluminum can be severely effected by corrosion, especially electrolysis which is present whenever 2 different metals are connected by an electrolytic solution (in this case, regular sea water).

The X scooters utilize a sacrificial zinc anode. This does an outstanding job of protecting the aluminum hull whilst completely submerged in salt water. Unfortunately, most of a scooter life is spent out of the water, and once out of the water the anode does nothing to protect any stainless steel/aluminum connections, or corrosion which can often be seen as bubbling paint on aluminum cylinders. (This is why many aluminum cylinders in tropical areas are not painted; they will last longer without paint).

Of course, if properly cared for the X-Sierra should have a long useful life; but in our experience many divers do not want to spend any more time on equipment maintenance as absolutely necessary.

### Handling:



Common X scooter myths investigated:

*“Brushless motors (as in X Sierra) are more powerful and efficient than brushed motors.”*

As demonstrated on page 1, the Submerge Brushed motor is both more powerful and efficient, propelling a diver at 182 feet/min with 18% less energy.

*“X scooter has 2 seals to the water, the N19 has 4. Therefore the X is less likely to leak.”*

Firstly, to be precise the X- Sierra has 8 potential leak points, twice as many as the N-19, if you include welded joints. Welds are potential points of watertight integrity failure, at some point over the lifespan of the device. Corrosion and stress cracking can occur in welds which does not occur in the homogeneous material. The N-19 has no welds at all.

In reality, scooters leak from 2 places:

- 1) shaft seal (Common to all scooters)

- 2) o-ring seal which is disturbed in order to charge the scooter. (Common to both scooters).

In conclusion, neither scooter is prone to flooding more than the other. Flooding is more a function of user error than the number of seals, if well designed.

*“X scooter handle eliminates trigger wire, replaces with a solid stainless steel rod; therefore eliminates problems with trigger wires”*

Historically, the problems with trigger wires were with older model scooters, designed before Submerge or X scooters existed. Often, the wire would fall off guiding wheels inside the handle of the scooter, for example, if the magnet switch became sticky and the trigger was released, the wire could become loose and jump off the wheel, making the trigger in-operable.

Given this problem, both the N-19 and X scooter designers shared a common goal to eliminate this problem.

The N-19 simply eliminated the wheels, the actual source of the problem, by designing the handle with a direct line of pull and capturing the wire so that there is nothing for it to fall off, even if the wire becomes slack. The N-19 wire simply can not detach itself from the mechanism without dis-assembling the components. In this way, the N-19 eliminated the real problem without creating any new ones.

The X scooter followed a different path. The complete elimination of the wire eliminated one problem, but the solid rod presented several new potential problems:

- 1) Solid rod is guided through a tight hole through a support, and into a tube which is welded to the housing and extends inside the scooter. This hole and tube, can become clogged with debris whilst the trigger is activated; preventing the trigger from moving back into the released position, and resulting in a stuck-on runaway scooter.
- 2) The welded aluminum tube which extends into the Sierra scooter is in close contact with the stainless steel rod; this presents the potential for corrosion inside the tube which can't be easily inspected. If damage does occur, repair would require re-welding or an entire new tail section.
- 3) The trigger part of the rod is attached to the rod with a single bolt, which has the potential to fall off rendering the trigger inoperable.

## **Conclusions:**

The X- Sierra is the lighter scooter. The N-19 has the advantage in the categories of speed, 50% better runtime to weight ratio, and all major components are impervious to corrosion. For travelers, the N-19 makes a second dive possible without the need to purchase an extra and expensive \$735 battery pack. It also allows almost double the runtime at cruise speed; without a significant weight or length penalty. Clearly we prefer the N-19 scooter and we have provided the information on which our opinion is based. Nevertheless, you will be getting a superb device backed by dedicated individuals, no matter which brand you dive.